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TRAUMATIC RUPTURE OF THE LIVER*

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TRAUMATIC rupture of the liver is among the least common of the abdominal emergencies confronting the surgeon. The extreme rarity of the condition, and the fact that associated injuries are not infrequently present, oftentimes renders the diagnosis difficult or impossible.

The liver, by virtue of its size, weight and consistency, is rendered particularly vulnerable to injury, especially if the impact is sufficient to fracture any of the ribs surrounding it or to cause an anteroposterior compression of the thoracic cage, producing an impingement of the liver between the force anteriorly and the prominent, unyielding vertebral column posteriorly.

TABLE 1.—*Type of Operative Repair Used on the Seven Patients Operated on Within Eight Hours of Injury, and Recovered*

Gauze pack	2
(Mattress)	2
Suture (interrupted)	1
Hemorrhage had stopped—no treatment	2
Type of Operative Repair Used on the Five Patients that Were Operated on Within Eight Hours of Injury, and Died	
Gauze pack	3
Number 4 plain catgut (interrupted)	1
Splenectomy and mattress sutures of chromic	1
Mortality	41⅔%

SIGNS AND SYMPTOMS

Before discussing the signs and symptoms of traumatic rupture of the liver, it might be well to review Moynihan's classification of subcutaneous injuries of that organ. He divides them into three classes as follows:

1. Rupture of the liver with laceration of Glisson's capsule.
2. Separation of the capsule with subcapsular hemorrhage; and
3. Central rupture, leading to hematoma, and thence to abscess or cyst formation.

The most notable clinical signs of ruptured liver are the result of internal hemorrhage.

Weakness and pallor will develop as the bleeding continues and will be followed by restlessness and dyspnea.

The pulse becomes rapid, weak and thready, and this is accompanied by a fall in blood pressure.

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TABLE 2.—*Type of Operative Repair Used on the Twelve Patients Operated on Longer than Eight Hours After Injury, and Recovered*

Gauze pack	6
No treatment—bleeding had stopped	5
Omentum found lodged in tear in liver and was not disturbed	1
Type of Operative Repair Used on the Eight Patients that Were Operated on Longer than Eight Hours After Injury, and Died	
No treatment—bleeding had stopped	1
No treatment because patient died on table	1
Gauze pack	5
Splenectomy done but overlooked six-inch tear on posterior aspect of right lobe of liver	1
Mortality	40%

Shifting dullness may or may not be present in the flanks.

Right upper quadrant pain, tenderness and rigidity are practically always present.

McKnight states that if the convex portion of the right lobe is injured, the pain is referred to the right scapular region as in cholecystic disease. If the concave surface is injured, the pain is referred to the waistline anteriorly.

The temperature may be subnormal early, and is a distressing sign if it does not rise after a few hours; because failure to rise indicates the patient is not responding favorably to treatment.

Another distressing symptom is the fact that if hemorrhage continues there will be a gradual decline in the red-blood cells and hemoglobin but an increase in the number of leukocytes. There should be a definite rise in the leukocyte count within two hours after the onset of the hemorrhage; and this rise should reach a maximum within eight hours, at which time the number of leukocytes should be at least twice the normal.

TABLE 3.—*Types of Violence in One Hundred Cases of Ruptured Liver*

Pedestrian versus automobile	46
Automobile versus automobile	20
Bicycle versus automobile	4
Blow in epigastrium during fight	4
Falling from a height	3
Thrown against a steering wheel	3
Miscellaneous	20

Shock is usually present due either to associated injuries or to peritoneal irritation, caused by blood and bile. If symptoms of shock continue longer than six hours, hemorrhage or peritonitis is usually present.

Jaundice may or may not be present, but usually does not appear before the second or third day.

TABLE 4.—*Blood Counts Were Done for Twenty-five Patients*

Total white count 16,000 or over	14
Total white count less than 16,000	11
Polys 80 per cent or over	10
Polys 80 per cent or under	6
Total red count over 4,000,000	7
Total red count under 4,000,000	18
Hemoglobin over 70 per cent	9
Hemoglobin exactly 70 per cent	6
Hemoglobin under 70 per cent	5

TABLE 5.—*Results*

Number of patients operated on who died	13
With associated injuries	12
Without associated injuries	1
Number of patients operated on who recovered	19
With associated injuries	11
Without associated injuries	8

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of traumatic rupture of the liver calls first for a classification of the abdominal organs into two groups, namely:

1. The solid viscera: Liver, spleen, pancreas, and kidneys.

2. The hollow viscera: Intestines, bladder, ureters, and stomach.

Injury to solid viscera causes hemorrhage. Injury to hollow viscera usually causes peritonitis. Both types of lesion are accompanied by shock, while injuries to the upper abdomen cause more serious shock than those of the hypogastric region.

Rupture of the spleen should really be mentioned last because the symptoms of this condition are practically identical with ruptured liver.

TABLE 5*(A)*—*Commonest Types of Associated Injuries in Groups Listed in Table 5*

Thirty-eight per cent of patients operated on had fractured right ribs.
Another twenty-five per cent operated on had contusions on right chest and no fractures.
Therefore sixty-three per cent of patients operated on had either fracture or contusion of right chest.
Another sixteen per cent operated on showed no evidence of contusion or fractured ribs.

The hemorrhage from a ruptured spleen is more rapid and severe because the blood flowing to the spleen is arterial and under high tension, whereas that coming to the liver is largely venous and under low tension.

In general it might be stated that if the trauma were applied to the left half of the upper abdomen the likelihood of ruptured spleen would be considered. There are exceptions to every rule, however, since such a case history was recently reviewed by me where a preoperative diagnosis of ruptured spleen was made and at operation the left lobe of the liver was found almost completely severed from the organ.

The pancreas is so situated that it is rarely injured and its symptoms are in no way distinctive. Shock is always quite marked.

In rupture of the kidney, the pain is usually localized to the loin and lumbar region. Hematuria is usually present.

TABLE 6.—*Moynihan's Classification of Ruptured Liver*

1. Rupture of the liver with laceration of Glisson's capsule.
2. Separation of the capsule with subcapsular hemorrhage.
3. Central rupture leading to hematoma and thence to abscess or cyst formation.

TABLE 7.—*Time Periods in Relation to Operations and Results*

Number of patients operated on within eight hours	12
Number of patients operated on within eight hours recovered	7
Number of patients operated on within eight hours died	5
Mortality	41⅔%
Number of patients operated on after eight hours	20
Number of patients operated on after eight hours recovered	12
Number of patients operated on after eight hours died	8
Mortality	40%

Rupture of the intestines is the commonest cause of peritonitis after abdominal injury. Cope states that if a chest lesion and renal trauma have been excluded, one is probably dealing with a case of ruptured intestines in the following conditions:

1. When abdominal pain persists for more than six hours after an injury, if the pain is accompanied by either (a) vomiting, especially bilious vomiting, (b) a pulse gradually rising from the normal, (c) persistent local rigidity tending to extend, or (d) deep local tenderness with shallow respiration.

TABLE 8.—*Cope States that if a Chest Lesion and Renal Trauma Have Been Excluded, One Is Probably Dealing With a Case of Ruptured Intestines in the Following Conditions*

1. When abdominal pain persists for more than six hours after an injury, if the pain is accompanied by either
   (a) Vomiting, especially bilious vomiting, or
   (b) A pulse gradually rising from the normal, or
   (c) Persistent local rigidity tending to extend, or
   (d) Deep local tenderness with hollow respiration.
2. When abdominal pain is absent or very slight and anemia is not increasing, but the pulse rises steadily hour by hour and the patient is very restless and listless.

2. When abdominal pain is absent or very slight and anemia is not increasing, but the pulse rises steadily, hour by hour, and the patient is very restless or listless.

Traumatic rupture of the stomach is rare but may occur following a blow on the epigastrium after a full meal. Rarer still is spontaneous rupture of the stomach. I had occasion to operate on one recently, closing a rent 5 centimeters long on the lesser curvature. In this condition the shock is severe and prolonged. There is severe epigastric pain and vomiting. Hematemesis invariably occurs because the

TABLE 9.—*Signs and Symptoms of Ruptured Liver*

Internal hemorrhage
- Weakness
- Pallor
- Restlessness
- Dyspnea
- Rapid pulse
- Fall in blood pressure
- Shifting dullness
- Right upper quadrant pain
- Subnormal temperature
- Anemia
- Leucocytosis

Shock
Jaundice

mucosa is the first layer to rupture as a result of intragastric pressure.

In ruptured bladder the pain is usually lower down and may be associated with a fractured pelvis if the rupture is extraperitoneal. Intraperitoneal rupture of the urinary bladder is among the least common of the injuries sustained as a result of trauma to the genito-urinary organs, perhaps because of the protection afforded it by the bony pelvis. Several different methods of ruling out an intraperitoneal rupture of the urinary bladder are described in the literature. In 1890 Keen suggested injecting air into the bladder through a catheter. A pneumoperitoneum resulted if an intraperitoneal rupture of the bladder was present; but if the bladder wall was intact an area of tympany would be noted in the hypogastric area. Vaughn and Rudnick have suggested the injection of air into the bladder followed by an x-ray flat-plate of the abdomen with the patient in the upright position. If an intraperitoneal rupture is present air will be noted beneath the diaphragm. If an extraperitoneal rupture is present air will be noted along the fascial planes of the muscles of the thighs. Another common but oftentimes misleading method of diagnosis is to inject a known quantity of fluid through a catheter into the previously emptied bladder, then measuring the amount of fluid returned. If an intraperitoneal rupture of the bladder is present the amount of fluid returned will be negligible or at least considerably less than the amount injected. This method is subject to error, however, and is not entirely reliable. Simple catheterization may also be misleading, since the tip of the catheter may pass through a rent in the bladder wall into the peritoneal cavity and 1500 or 2000 cubic centimeters of bloody urine will be removed from the peritoneal cavity. Furthermore, the tip of the catheter may pass to the floor of the bladder and remove 200 or 300 cubic centimeters of clear urine which has accumlated in the bladder below the rent following the injury. Probably the most reliable method of ruling out a ruptured urinary bladder is the injection of a contrast media such as Skiodan. An x-ray will reveal an extravasation of the contrast media if a rupture is present.

In an effort to arrive at some means of early diagnosis and the best method of treatment, I have been prompted to study one hundred cases of traumatic rupture of the liver admitted to the Los Angeles County General Hospital during the past ten years. In this series of one hundred cases thirty-two of them were operated on with a mortality of 40 per cent.

The preoperative diagnosis of ruptured liver was correct in eighteen cases, or 54 per cent. The remaining sixty-eight cases constitute the unoperated cases in which the diagnosis was confirmed at autopsy.

TREATMENT

Opinion is divided as to whether or not immediate operation is essential. Cheyne and Burghard believe that recovery from primary shock in severe liver injuries is impossible until after the arrest of hemorrhage. They believe that ruptured liver becomes an operative condition as soon as the diagnosis is made. This view is at variance with that of McCracken in his treatment of ruptured spleen where the bleeding is arterial and under higher tension than in the case of liver hemorrhage. He has concluded after studying nineteen cases of ruptured spleen, that patients admitted in shock should not be operated on at once, but should be tided over the period of shock before surgical measures are instituted.

In the treatment of shock the usual methods of reversed Fowler's position and the administration of external heat should be employed. Plenty of fluids should be given by proctoclysis and hypodermoclysis. Morphin in sufficient quantities for rest and quiet is indicated. As soon as there is any improvement in the patient's general condition, surgery is indicated if we have reason to believe internal hemorrhage is present. If the clinical picture and the laboratory findings indicate considerable blood loss, a blood transfusion just before or during the operation will combat the anemia and serve as an aid to hemostatis.

Thorlakson and Hay believe that a properly placed incision has an important bearing on convalescence. They believe the upper right transverse incision has certain definite advantages over the longitudinal incision. First, it lends itself more easily to exploration of the upper abdomen and right lobe of the liver; second, the gauze packing can be brought out well around toward the flank, thereby lessening the likelihood of symptom-producing adhesions around pylorus or duodenum; third, in their experience with this incision in gallbladder surgery, postoperative hernia does not occur even following prolonged drainage.

During the actual operation the patient's condition is usually serious. Careful planning, therefore, of the procedure and details of the operation should be methodically carried out. The dome of the liver may have to be explored to find the site of the injury. It may further be necessary to tilt the whole organ forward by grasping the liver margin with gauze and pulling the liver downward and anteriorly. In fact, most ruptures are said to occur along the postero-inferior surface.

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CUTANEOUS LEISHMANIASIS, EXPERIMENTALLY PRODUCED

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CUTANEOUS ulcers, caused by the Leishmania tropica, are very common in certain parts of the Near East, where they are known under various local names, such as Aleppo boil, Oriental sore or Biskra button. They are very rare in the United States, being seen in immigrants from districts where the disease is indigenous. It may be of some interest, therefore, to report a case of such an ulcer which followed experimental inoculation of the human skin with cultures of the organism.

REPORT OF CASE

Miss F. S., age 35, consulted me on July 21, 1939, with the self-diagnosis of Leishmania tropica ulcer of the right